The Projected Ability of General Aviation to Adapt to a Comprehensive Mandated Safety Program

by

Zachary K. Hutcherson

A thesis presented to the Honors College of Middle Tennessee State University in partial fulfillment of the requirements for graduation from the University Honors College

Fall 2015

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Zachary K. Hutcherson

APPROVED:

_____

Dr. Paul Craig
Department of Aerospace

_____

Dr. Wendy Beckman
Department of Aerospace

_____

Dr. Philip E. Phillips, Associate Dean
University Honors College

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Abstract

This research is designed to identify the potential impact that mandating a safety management system (SMS) could have on flight training and general aviation environments. Specifically, to what extent flight schools already comply with a theoretical SMS program, and which categories of flight schools are least compliant. The first step is to develop the theoretical SMS model, and then compile a list of questions targeting each SMS component. Through surveying the Southern region's flight schools, an impact analysis can be compiled to identify who would require the most substantial changes to comply with an SMS style program. Results indicate that Part 61 and Part 141 schools would require the greatest change, while Collegiate Programs are nearly in compliance with SMS already.

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Introduction

Safety is a constant topic of conversation in the air transportation industry. As large airliners take to flying farther, faster, and higher, one may easily forget that the foundation of aviation lies in general aviation. The Aircraft Owners and Pilots Association (AOPA) defines general aviation as "all civilian flying except scheduled passenger airlines" (What is general aviation, 2009). Additionally, AOPA states that, "more than 90% of the roughly 240,000 civil aircraft registered in the U.S. are GA aircraft . . . and of the 625,000 pilots, an estimated 500,000 fly GA airplanes" (What is general aviation). These statistics prove that an overwhelming majority of aircraft and airmen fly in a non-airline environment. In addition, the National Transportation Safety Board (NTSB) reports that in 2014, GA operations experienced 1,234 accidents and incidents, with 294 resulting in fatalities, compared to only twelve accidents and incidents in scheduled air carrier operations, resulting in zero fatalities (NTSB, 2015). However, although most aviation activity consists of general aviation, new safety programs ignore general aviation altogether and target only major airlines.

The Federal Aviation Administration (FAA) is the governing regulatory body that oversees aviation in the United States. For over a decade, the FAA has implemented new safety programs in the airline environment centered on the Safety Management Systems (SMS) (FAA, 2014). SMS is a new way of promoting safety culture, identifying and mitigating risks, and encouraging policy development with safety oriented focus (FAA, 2014). It also provides an assurance process to review data and determine effectiveness of its safety programs (FAA, 2014). The

FAA defines these areas as the four pillars of SMS: safety policy, safety risk management, safety assurance, and safety promotion. Although SMS has been around since the early 2000s, its primary downfall has been the FAA's inability to integrate it fully outside of the scheduled airline and charter environments (SMS Explained, 2013). While current airline operations require a SMS program, none of its GA counterparts requires one (2013).

Literature Review

Evidenced by the disparity in GA safety programs, the GA environment has faced severe neglect for the past 20 years. As SMS has taken the front lines in reducing airline risk, the FAA now faces the daunting task of extending SMS to GA. To accomplish this goal, the FAA released a program in 2011, known as the 5-Year Plan (The Plan), which seeks to bring components of SMS to the GA environment through "voluntary participation." The voluntary aspect of the program is unique, as other countries currently mandate safety programs for all levels of aviation operation, with Canada being the primary example (SOR/96-433, 2015). The 5-Year Plan outlines a series of programs and reforms that aim to develop a new level of safety throughout local aviation programs (Flight Standards Service, 2011). However, this plan does not exactly mirror SMS despite the existence of similarly named components.

Specifically, the FAA replaced elements of SMS with voluntary training and outreach/engagement events (Flight Standards Service, 2011). The FAA made this decision because it wanted to "expand focus on [flight instructor] training, remedial [pilot] training, and academia" (Flight Standards Service, 2011). Essentially, the

FAA sought to replace corporate policy with government mandated training, and to replace assurance programs with an outreach division designed to target "aviation associations, clubs, manufacturers, insurance providers, and academia" (Flight Standards Service, 2011). However, statistics are showing that these modifications, coupled with the FAA's lack of mandated participation, has resulted in a *laissez-faire* approach to safety that simply is not working (GAO, 2011).

Moreover, the Government Accountability Office (GAO) developed an analysis of the FAA's response to a startling 2001 study that showed general aviation contains accident rates 20 times that of commercial operations. In its study, the GAO attempted to identify how the FAA is responding to this trend; it concluded that the FAA has implemented a variety of programs and safety seminars designed to counter the most common causes of GA accidents (GAO, 2011). Unfortunately, the study also reported dismal attendance and lack of participation in the afore-mentioned programs and seminars (GAO, 2011). In response to the lack of participation, in 2008, the FAA developed a 10-year plan and a 5-year plan to accomplish two goals: to establish a specific end goal in safety improvement in general aviation (GA) and to develop a new strategy to approach safety in the general aviation world (GOA, 2012). However, according to a second GAO study conducted in 2012, the FAA is currently not meeting those intended goals. It is important to note that neither the FAA's 10-year plan, nor the FAA's 5-year plan involved any SMS elements (GAO, 2012).

Understanding the previous attempts to combat GA accidents is important because as the GAO stated, its attempts are not meeting intended goals in the

manner the FAA desires (GAO, 2012). In fact, the only safety program with substantial results is SMS (Stoltzer and Halford, 2010). The accident rates in the airline industry decreased sharply after the implementation of SMS (the only time in history to do so), and when compared with GA accident trends, the statistics show that GA is decreasing at a very shallow rate (Stoltzer and Halford, 2010). Figure 1 is from a study of GA accident rates per 100,000[1] flight hours; the results show that commercial accident rates are almost non-existent when compared to that of GA (Garibay and Young, 2013). One may argue that commercial pilots receive more training, thus have a lower accident rate. While it is true commercial pilots receive more training, SMS is still responsible for the overall decrease in airline accident rates, as commercial accidents were also substantial higher prior to the implementation of SMS. Prior to SMS implementation, accident rates in the commercial industry were much higher despite the additional training commercial pilots received. The implication is clear: the FAA is trying to move towards proactive programs, and the only proactive program that has demonstrated success is SMS. With the 10-year goal approaching rapidly, speculation as to whether SMS will be attempted at the GA level is becoming very real.

[1] Purdue researchers normalized the data using a 100,000 hour metric due to constraints on NTSB accident database data presentation.

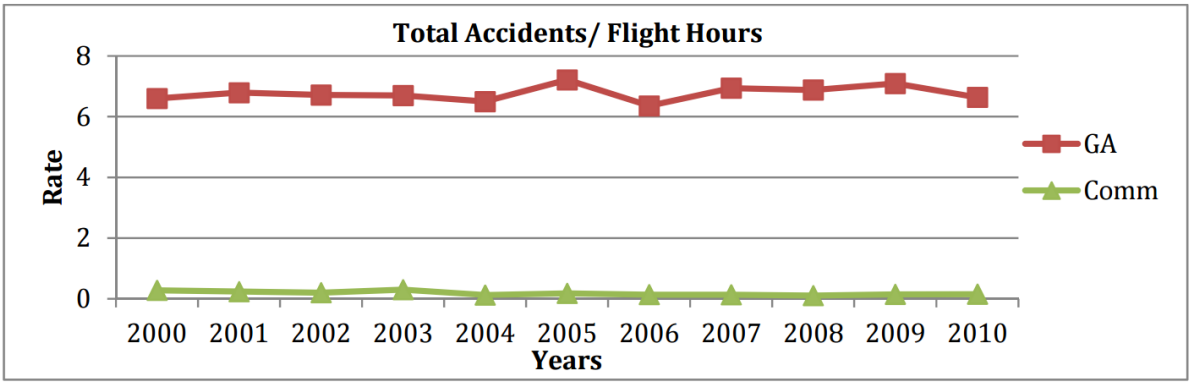

Figure 1. Total accidents per flight hours (Rate).

With the success of SMS in the airline environment, the FAA has publically acknowledged its intent to move forward with SMS for future safety initiatives (MITRE Corporation, 2012). It has chosen to promote "non-regulatory, proactive, and data-driven strategies" in its everyday operations. Therefore, the FAA's main priority is no longer mandating a regulation, but instead developing a proactive program (Duquette and Dorr, 2012). The SMS model fits closely with this proactive program, as the fundamental component of SMS relies on proactive data collecting and assurance of the program's effectiveness (Hale, et al., 1997). With the FAA's new approach in mind, one can conclude that: (1) the FAA is pleased with the results of SMS and (2) the FAA will continue to refine SMS to better fit the general aviation environment.

When determining where to begin implementing its SMS program, the FAA relied on a Purdue research study that focused on reducing the amount of GA accidents. (Garibay and Young, 2013). The study showed that utilizing a safety net to reduce accidents resulting from human error was necessary (2013). Unfortunately, the analysis concluded that GA pilots are hard to govern systemically like airline

pilots, as GA operations are often single-pilot and provide no system of checks and balances (2013). This means that the FAA would need to begin its SMS implementation at the most logical point: the flight schools in which pilots are trained. For purposes of this research, only the application of SMS to flight schools will be analyzed; however, the FAA could also apply an SMS program to airport operators and managers, requiring all local pilots to participate.

Terms and Definitions

In order to utilize common terminology throughout the paper, the following terms and definitions are compiled to standardize meaning.

Category 1 School: A flight school conducting operations under Title 14 Code of Federal Regulations (CFR) Part 61 for any level of pilot certification with less than 50 students.

Category 2 School: A flight school conducting operations under Title 14 CFR Part 61 for any level of pilot certification with 50 or more students.

Category 3 School: A flight school conducting operations under Title 14 CFR Part 141 for any level of pilot certification with less than 50 students.

Category 4 School: A flight school conducting operations under Title 14 CFR Part 141 for any level of pilot certification with 50 or more students.

Category 5/CTP School: A flight school conducting operations under the direction of a college or university with degree seeking capability. May or may not be AABI accredited.

Safety Management System (SMS): A set of policies, guidelines, and procedures that govern operations of aircraft and organizations for the purposes of increasing safety through prevention, mitigation, error reporting, and assurance.

Methodology

The objective of the study was to determine how flight schools would be impacted if the FAA decided to implement SMS into general aviation training. The flight school is the hub of general aviation, conducting training[2] for all the nation's civilian pilots (Wally, 2001). The goal of this research is to answer three questions:

1. *What will be the likely components of a general aviation based safety management system?*
2. *How many flight schools contain some of these components and to what extent?*
3. *Which programs are more likely to require substantial change as a result of a mandated SMS program using the model from question 1?*

Regarding the first question, determining the components of the system was accomplished through the use of primary and secondary sources related to airline SMS programs. While developing the key components of a GA-oriented SMS was accomplished by using the published standards of the Aviation Accreditation Board International (AABI) and working knowledge of the industry. Sources include the FAA's SMS Explained website, research publications on modelling safety management systems, and the *Safety Management Systems in Aviation book*. Specific

[2] Training is for initial certification, recurrent certification, or add-on certifications. For our purposes, it could be for any of the above.

and generalized components of this theoretical model are then detailed and outlined.

The second question was addressed through a systematical survey sent to the FAA Southern Region's flight schools and college training programs. The survey was developed utilizing the components created in the first step. For purposes of the survey, those general components were translated to a more tangible object. For example, the data review step of safety assurance was translated to the survey question, "Is collected data self-audited to identify trends? "(Appendix A). This means that the general component is Safety Assurance[3] and one possible component of Safety Assurance is analyzing safety data to find trends in the program. The survey responses were collected and grouped into categories relating to type of operation and size of program. Finally, a percentage of how many SMS components the school had compared to the complete SMS program was calculated (Appendix B).

The third question was answered by breaking down the data into its individual SMS components and further into its respective categories. Then, each category of school's preparedness was analyzed for trends. For example, a category 1 school is a small school operating under rules of part 61.[4] All of the category one schools' responses could be compared to all of the category 5 schools' responses to identify which program would be more adaptable to a new SMS program, and in

[3] Safety Assurance is the process of using collected safety data to identify trends and then adapt your program to counter the developing trends. See results and discussion.
[4] See terms and definitions for a complete list of categories.

which categories the deficient school would need to focus on to bring itself into compliance.

To summarize, the mock SMS program was developed utilizing expert analysis of modern SMS in airlines and other industries. The mock SMS program contained specific and generalized components as they applied to general aviation. Each component was then translated into a question on a survey that was distributed to flight schools across the southeastern United States. Responses were analyzed and grouped according to size and type of operation, and then the data was compared across school categories to determine which categories were most affected, the total percentage lacking in full compliance with the mock program, and which specific components were missing from the school's program.

Component Identification

In order to determine the impact SMS would have on general aviation, one must first identify the specific components that would make up the theoretical safety program. First, broad categories were defined using SMS theory. According to the FAA's SMS Explained website and *Safety Management Systems in Aviation* textbook, a fully developed SMS is built on four fundamental pillars. To illustrate these components, a simple example will be used to show how SMS could be implemented and its benefits: the theoretical program discussed below will be applied to a company trying to prevent its passengers from being struck by the propeller of an aircraft.[5]

[5] This example will be carried on throughout the "Theoretical SMS Components" section to induce a practical understanding of each SMS component. This example comes from the "Modelling of Safety Management Systems" publication.

Theoretical SMS Components

The first pillar of SMS is Safety Policy (SMS Explained, 2013). Safety Policy is defined as, the "commitment to continually improve safety through defined methods, processes, and organizational structure needed to meet safety goals" (2013). Additionally, it is characterized through clear objectives, methods, processes, documentation, and transparency of both prevention and reactive measures to safety violations (Hale, et al., 1997). An example of Safety Policy in action would be to provide passengers entering the terminal with a written document that outlines the hazards associated with propellers and the front of an airplane.

An additional SMS pillar is Safety Risk Management (SMS Explained, 2013). Safety Risk Management is accomplished through the determination of risk control techniques based on describing the system in which the team operates, identifying hazards associated with that system, assessing the risk of those hazards, and developing methods to control the risk (Hale, et al., 1997). Industrial Safety Manager James Reason additional states that, "risk management and control is accomplished with proactive measures and programs that fit the user" (Reason, 1997). An example of risk mitigation would be erecting a fence around a passenger boarding area to prevent passengers from accidently walking into the propeller. While an obvious and simple example, this line of thinking is used to identify a hazard and implement a control technique.

The third pillar of SMS is Safety Assurance (SMS Explained, 2013). Safety Assurance is characterized through the "evaluation of the continued effectiveness of

implemented risk control strategies and supports the identification of new hazards" (2013). It also requires audits, both internally and externally, to identify trends in safety incidents and collects data through anonymous sources to obtain trends; its focus is to evolve the program to meet new challenges (Hale, et al., 1997). An example of safety assurance is reviewing safety reports to see if passengers have been injured by a propeller recently; if no reports occur regularly, then it can be assumed that the policy and management techniques in place are successful. However, regular reports occur, then the assurance process says changes in policy, mitigation, or promotion techniques are necessary.

The fourth and final pillar of SMS is Safety Promotion; this primarily focuses on training and awareness of hazards and risks, encouraging participation in the reporting process, and disseminating and discussing lessons learned (SMS Explained, 2013). Additionally, it could include elements of round-table seminars or table-top scenarios that encourage active participation in learning new hazards (Hale, et al., 1997). Additionally, Safety Promotion attempts to develop a culture within the organization to draw total participation around the safety program in place; this develops the SMS program as a company regimen (Bottani, Monica, and Vignali, 2009). An example would include reading a report of a passenger injury resulting from the propeller, then openly discussing ways to prevent the accident from occurring or conducting crew training on passenger safety briefings.[6]

[6] Refer to Appendix A for a total summary of survey questions as classified into each pillar.

Safety Policy Components

The success of Safety Policy in SMS relies heavily on documented, established, and consistent methods of approaching safety (Stolzer and Halford, 2010). To achieve this, flight schools would need to develop their own policies and procedures that outline a variety of information related to safety, normal operations, and abnormal operations (Hale, et al., 1997). With this is mind, the following questions were utilized to identify a variety of components a school may or may not need to implement to comply with Safety Policy criteria:

1. Does your program establish safety goals and objectives?
2. Are your safety goals clearly stated and visibly posted to those operating in the building?
3. Does your school publish a document outlining your program's operation that is readily available to students and staff?
4. If "yes" to the previous question, does it include any of the following:
    a. Fleet Information, Operating Limitations, Incident Reporting Process, Safety Program Manager information, Emergency Action Plan, off-site emergency procedures, line operations, maintenance discrepancy process, outline of safety goals, program, and commitments, FAA FSDO contact information, and customization to student pilot certificate levels.
5. Does **each** student receive a copy of aircraft checklists and flight operating procedures for the aircraft he/she is flying?

6. If your program rents aircraft, are renters required to undergo the same safety training as students?
7. If your program rents aircraft, are renters subject to the same rules and operating limitations as students?

These specific components are essential in creating specific policies and written guidelines that comply with the Safety Policy pillar in SMS (Yen, et al., 2008). The above questions establish a written procedure for dealing with normal and abnormal operations, develop and display goals to strive for, and disseminate the information to ensure clear understanding. According to *Safety Management Systems in Aviation*, these components are essential for any SMS operation, so it can be reasonably assumed that a mandated SMS program will include these components.

In addition to the above questions, respondents were asked to rate themselves on a scale of one (not at all descriptive) to ten (perfect description) on the accuracy of the following statement:

> My program's managers actively promote safety throughout the organization, not only through words, but also through actions. The program has clearly defined methods and processes to preserve safety, and there are established goals and objectives to meet. There is transparency in the safety program, and all incidents are fully documented with a resolution process. Results of this resolution

process are distributed publically. Managers promote cross-organizational communication and cooperation.

The above statement was utilized as a personal evaluation of their own program from each respondent's perspective. The goal was to make the respondents think critically about the statement and rate themselves unknowingly on their compliance with safety policy. This evaluative statement was created using three sources that describe what Safety Policy means (SMS Explained, 2013; Stolzer and Halford, 2010; Hale, et al., 1997). Thus, if a respondent answers "10" on its survey, then its perspective is that its program is fully compliant with all aspects of Safety Policy in an SMS program.[7]

Safety Risk Management (SRM) Components

As previously stated, SRM is intended to identify and mitigate every day and long-term operational risks and hazards (Reason, 1997). To do this, the FAA states that one must have a formal process of describing and identifying current risks, assessing future risks, and controlling all risks and hazards encountered (SMS Explained, 2013). Dr. James Reason describes an effective SRM as being multi-dimensional, proactive, and all inclusive; in other words, it must counter all current and predicted future risks (1997). The following questions were used to identify specific components of a flight school SRM program:

1. Does your program require maintenance problems to be reported to a central person/office?

[7] This is important as their perceived compliance will be compared to their actual compliance.

2. Does your program have a risk management plan that clearly identifies each risk your program faces and suggests ways to mitigate each risk?
3. Does your program have a risk identification process that actively seeks out current and evolving risks?
4. Is there an individual responsible for risk assessment and mitigation?
5. Have local emergency responders been briefed on your operations and hazards associated with your program and aviation?
6. Does your program have a proactive plan to assess hazards?

However, one problem with the above set of questions is that vague language was used to describe the individual components. For example, "risk management plan," "risk mitigation," and "risk identification process" are all terms that a lay person might not be familiar with unless he or she has received formal SMS training. While there has been some speculation on specific risk processes that could be used for GA, most airlines have unique and individually tailored SRM plans, so asking specific questions would be nearly impossible (Yen, et al., 2008). As a result, broad questions are the best alternative.

Additionally, respondents were asked to rate themselves again on a statement that summarizes the purpose of SRM. This statement was drafted with language that identically matches fundamental SRM components (SMS Explained, 2013; Reason, 1997). This statement follows the core components of SRM and other risk mitigation principles and reads as follows:

> My program actively identifies risks and has a plan in place to control risk. Our risk management plan is published for all to see, and we support involvement of students and employees in containing and identifying risk. This is a formal process that documents the risk itself, hazards associated with it, and methods to control the risk.

Its intent was to judge the respondent's own perception of its SRM readiness: a score of "10" indicates that it feels fully compliant, whereas, a score of "1" indicates no compliance at all. The key element of SRM is that it is a formal process with written processes and methods for classifying and controlling risks; it is not a casual conversation about hazards (Glendon and Clark, 2007). A respondent with a rating of "10" would have the feeling that its flight school is completely compliant with SRM, but when compared to the percentage of actual components in place, that may or may not be true.[8]

Safety Assurance (SA) Components

Safety Assurance (SA) is the key factor that differentiates between an average safety program and a true SMS program (Duquette and Dorr, 2012). This is because SA is the ability of an organization to adapt to and manage changing risks; this principle of managing change is the key component of any SMS (Stolzer and Halford, 2010). In fact, in a study of maintenance programs, it was found that those with SA components integrated in the workplace saw a significant decrease in repeat occurrences of mistakes, and more importantly, the trend line of total

[8] See Survey Results. Data revealed that in fact most schools do feel prepared with in actuality they are not.

mistakes made was consistently negative (Cromie, McDonald, and Corrigan, 2000). As the study indicates, managing and adapting to change is crucial for producing a reliable, long-term, safe workplace.

The FAA implores that SA be data-driven and require constant analysis of trends and effectiveness of various safety initiatives (FAA, 2014). With this in mind, the following questions were drafted to determine a school's ability to collect, analyze, and respond to data:

1. Does your training program have an anonymous reporting process for students and employees to report safety incidents?
2. In reference to the previous question, does voluntary disclosure protect the reporter from most ramifications?
3. Do you have a dedicated employee who is solely responsible for the management of your safety program?
4. Are students and employees encouraged to anonymously make suggestions about the safety program or operations?
5. Does your program collect and store data on safety incidents?
6. Does your program receive third party audits of its operations?
7. After a safety incident is reported, does someone assess your current safety program and operations to determine if changes should be made?

Note that many of the questions focus on the collection of data. According to James Reason, the collection of data is the essential component of determining whether

employees are actively utilizing the safety program, whether the safety program is working, and if changes need to be made (Reason, 1997).

Additionally, emphasis is placed on anonymous reporting and safeguard procedures for the reporting party. This is due to the enhanced ability to collect data if the reporting party feels reasonably protected from disciplinary action for genuine mistakes (Muniz, Peon, Ordas, 2007) Moreover, this style of data collection has seen great success in the airline industry with the introduction of the Aviation Safety Action Program (ASAP) (Yen, et al., 2008). The FAA has endorsed this style of data collection through its adoption of a National Aeronautics and Space Administration (NASA) Aviation Safety Reporting System (ASRS) (Wally. 2001). Through the ASRS program, pilots are encouraged to anonymously self-report violations, and the FAA cannot use those reports for disciplinary action (NASA, 2015). Extending this type of program to flight schools is a logical step, as this would develop a system of checks and balances to assure that a safety program is working properly; this system of checks and balances is reflected in the questions previously listed (Garibay and Young, 2013).

To gain an understanding of the current perceptions of SA in the flight schools surveyed, the following statement of evaluation was provided:

> My program evaluates the continued effectiveness of its risk control strategies and identifies new hazards. We ensure compliance with all regulations and go above and beyond what is required in a safety

program. We collect data and analyze that data for trends and regularly assess our safety program's effectiveness.

A response of "10" once again indicated a fully accurate statement, whereas, a response of "1" indicated a completely inaccurate statement. The results will then be compared to the respondent's answers to the SA components, and a comparison of actual and perceived preparedness for SMS SA can be determined.[9]

Safety Promotion (SP) Components

The final component of a program will address the Safety Promotion/Culture pillar (SP) of SMS. Since SP is designed to modify the culture of the company and enhance overall awareness and participation in SMS, it is viewed less as a pillar and more as an environmental condition. Figure 2 illustrates this, showing SP surrounding the other three pillars of SMS. The point of SP is to supplement SMS through behavioral modification; promoting incident reporting, participation in training, and group participation in risk mitigation (Hale, et al., 1997).

To reflect these values in the flight school environment, the following questions were used to identify components of SP:

1. Do employees from different departments meet to discuss operational concerns related to safety on a scheduled basis?
2. Do you have a dedicated student or group of students to act as safety ambassador(s) for the program?
3. Does your program conduct regular safety meetings with employees to discuss factors contributing to and factors degrading safety?

[9] See Survey Results, Perception vs Reality.

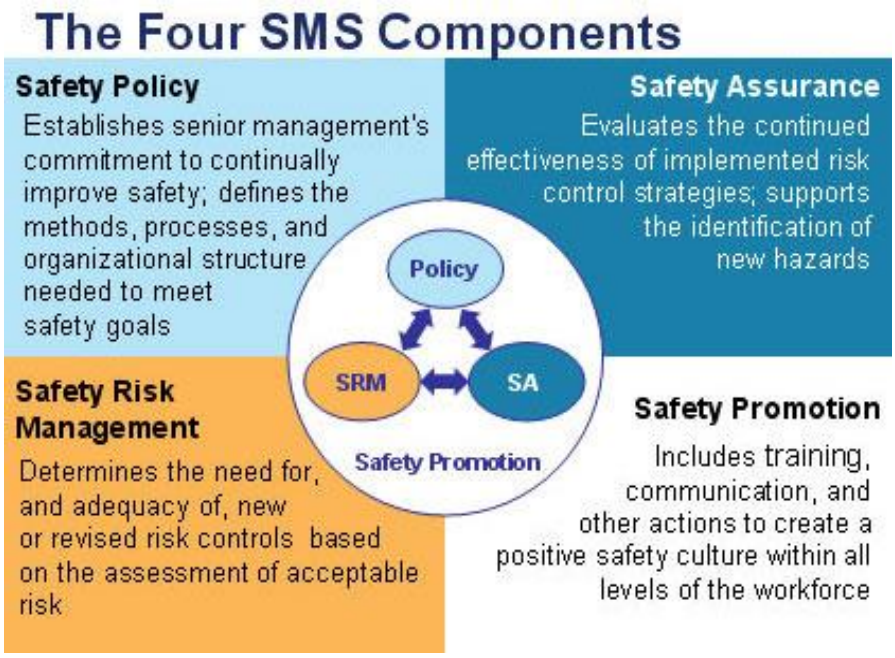

Figure 2. Functional SMS components.

4. Are new employees formally trained on your safety program/procedures?
5. Are all reported safety incidents distributed to employees and students for view?
6. Are new students formally trained on your safety program/procedures?

These questions are designed to gauge a flight school's ability to properly train, discuss, and openly promote safety from all departments and participants involved in the program. Essential to a proper safety culture is the ability to communicate across a variety of departments regarding safety; in fact, in a study of maintenance programs, those programs that promoted cross-training, inter-departmental communication, and open forums were found to have significantly higher participation rates in the SMS program and a statistically significant lower incident rate (Cromie, et al., 2000).

As before, there was also an evaluative question at the end of the survey asking the participant to respond to the following statement:

> My program actively promotes safety though all levels of the workforce. It includes training, communication, scenarios, and activities to strengthen our safety culture. Teamwork in safety is promoted and regular, open discussions amongst employees take place. Safety manager(s) are proactive in identifying hazards.

A response of "10" indicated fully accurate, while a response of "1" indicated not at all accurate. This statement was gathered using the exact textual description of SMS SP from the FAA SMS Explained website. If the participant feels this statement highly reflects its flight school, then its answer to almost all of the previous SP questions should be "yes." If the school did not have many of the components discussed, yet rates itself high on the descriptive scale, this means there is a disconnect between perceived readiness and actual readiness for an SMS program.

Survey Results

The results of the survey were used to determine the following key pieces of information: which categories of schools would need to make the largest changes, did flight schools understand SMS, and which component of SMS was most lacking. To answer these questions, each survey question was assigned a position as either a Safety Policy, SA, SRM, or SP category. Then a point value of zero, one, or two, was assigned based on the respondent's answer. A response of zero indicated the respondent did not have the component. A response of one indicated the respondent had partially fulfilled the component requirement, and a response of

two indicated full compliance.[10] Some questions had multiple parts and had a maximum score of two points: zero is non-compliant, one is partially compliant, and two is fully compliant. This was done to reduce survey length.

After assigning point values to each question, the following baseline scores were established:

- Safety Policy consisted of seven questions for a total of eleven possible points.
- Safety Risk Management consisted of six questions for a total of eight possible points.
- Safety Assurance consisted of six questions for a total of nine possible points.
- Safety Promotion consisted of six questions for a total of seven possible points.

Appendix B displays the responses of surveyed schools. It displays the category of school on the left, followed by point values across the row. At the end, the total percentage of each component was calculated, as well as the total percentage for the entire program was calculated. For example, response number one scored six points in policy, four in risk management, two in safety assurance, and three in safety promotion. This results in respective percentages of 54.5%, 50%, 22.22%, and 42.86%. The total number of points a response could score is 35 (this would reflect 100% compliance with SMS). Response number one scored 15 total points

[10] See appendix A for the list of survey questions. Appendix B for the data sheet of responses.

resulting in a total preparedness rating of 42.86%; this means that response number one has approximately 42% of the total components of SMS and would need to implement 58% of SMS to achieve compliance.

Utilizing this method, averages were obtained for category one, two, three, four, and five schools.[11] The averages for each pillar of SMS were calculated, as well as a total average for each type of program. A total of 40 responses were received out of an estimated 130 surveys sent. This participation rate was anticipated and provided enough data to secure adequate averages. According to Fluid Surveys, email surveys result in an average participation rate of 24.8% with 78.6% completion (Mirazaee, 2014). This survey's participation rate was 30.7% and three responses were removed due to lack of completion, resulting in a 92% completion rate.

Part 61 Results

Part 61 schools were predicted to be the most impacted if the FAA implemented SMS. The findings of the survey indicate that this prediction was correct. Figure 3 displays the results of all part 61 schools in each category of SMS, as well as a total category. The average for part 61 schools preparedness for safety policy is 50.91%; this number is very similar to SRM and SP averages coming in at 49.50%and 53.71%, respectively.

[11] Refer to terms and definitions for classification.

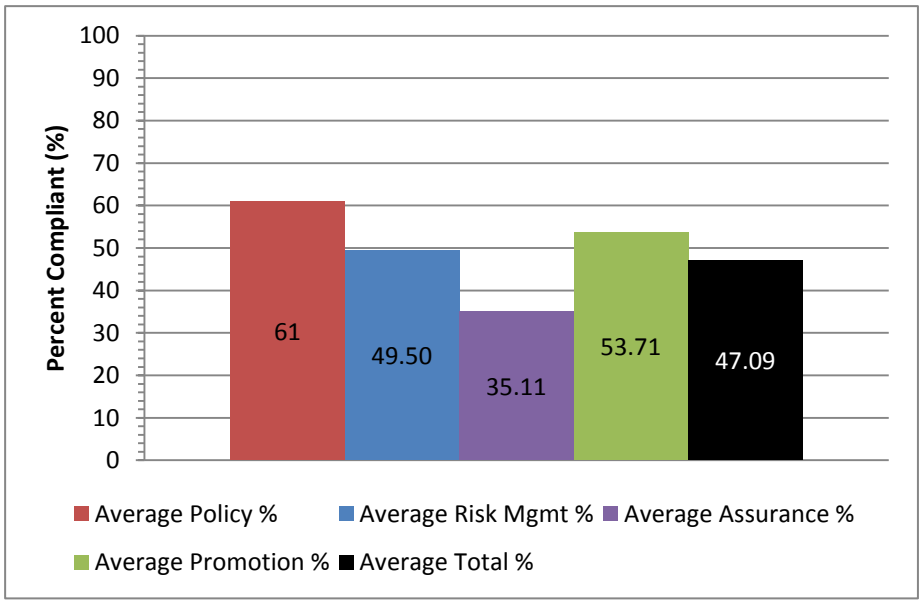

Figure 3. Part 61 percent compliance with SMS.

SA has the largest disparity at only 35.11% average readiness.[12] This means that the total average readiness for part 61 schools is 47.09%. This is important because it indicates that implementing a mandated SMS program would require substantial[13] changes for part 61 schools' safety programs. The area requiring the most amount of change is safety assurance, which as previously discussed, is perhaps the most crucial part of SMS (Stolzer and Halford, 2010).

Part 141 Results

Part 141 schools[14] had similar results to part 61 schools. It was predicted that part 141 schools would have a total preparedness that would not require substantial changes[15]. This predication proved accurate, as the total readiness percentage of part 141 schools is 54.29%. Although a 7% difference is not large

[12] This is important as SA will also reflect the largest total difference between programs.
[13] Defined as greater than 50%.
[14] Category 3 and 4 combined.
[15] This prediction was made in the thesis proposal.

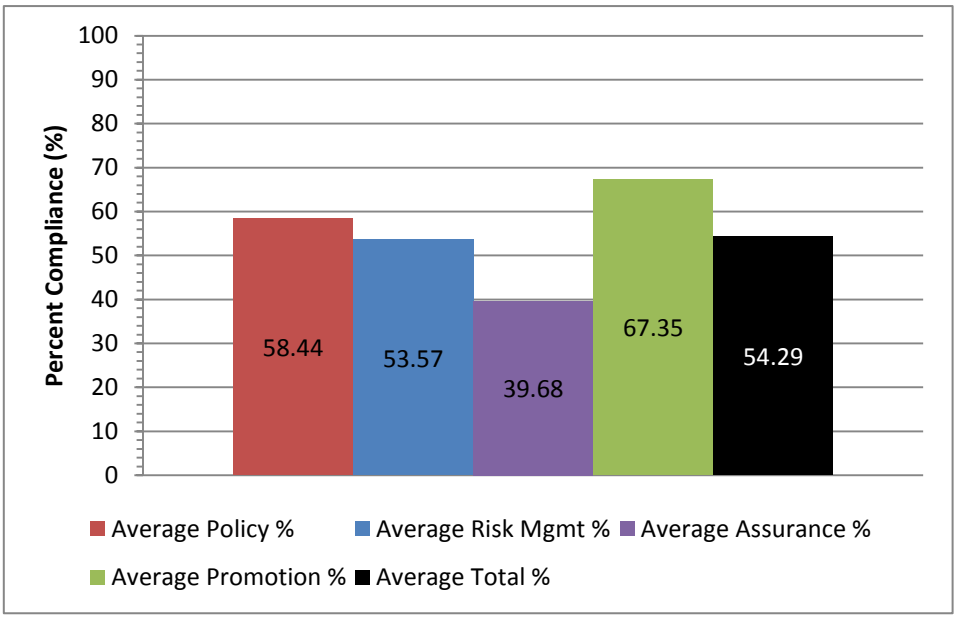

Figure 4. Part 141 percent compliance with SMS.

enough to separate part 141 schools from part 61 schools, as it is not statistically significant, it does indicate that part 141 schools are generally more prepared.

Figure 4 outlines part 141's total preparedness to an SMS program. Again, Safety Policy and SRM share similar readiness levels at 58.44% and 53.57%, respectively. While SA was again the largest deficient component at only 39.68% compliance. The largest statistical change was the increase of SP to 67.35%. This indicates that students and staff are more participative in training and meetings.[16] Part of this could stem from the FAA's more diligent supervision of part 141 schools compared to part 61 schools; in fact, there are no regulations governing personal instruction under part 61, but an entire regulatory section (part 141) exists for schools using part 141 instruction (CFR Part 141). Regardless, it appears that part 61 and part 141 lie at a similar readiness level, as both would require major overhauls to their data collection, analysis, and risk management programs.

[16] Evident from the type of questions asked in the survey. Refer to Safety Policy Components.

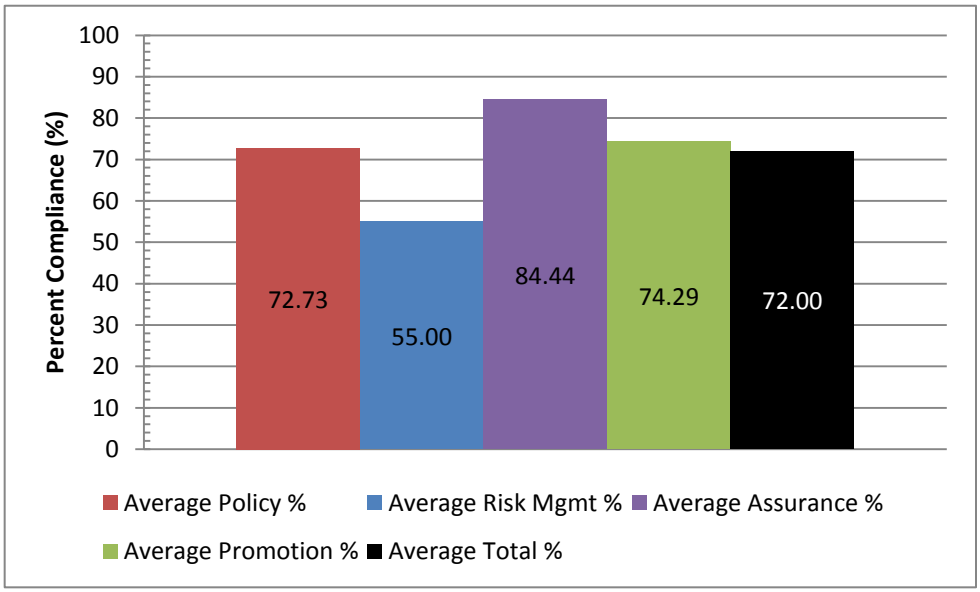

Figure 5. CTP percent compliance with SMS

Collegiate Training Program Results

Finally, results from college training programs (CTP) were averaged to determine their compliance with SMS. The data indicates a significant difference in CTP schools when compared to part 61 and part 141 schools. Figure 5 shows the collected data for CTP schools. The total preparedness level for CTP is 72.00%. Safety Policy compliance and Safety Promotion compliance are nearly identical at 72.73% and 74.29%, respectively. Surprisingly, SRM did not increase significantly over part 141 or part 61 with a total compliance level of 55.00%. This indicates that all categories lack a fully-developed risk management and mitigation plan.

The final pillar of SA displays the largest change from part non-CTP programs: average SA compliance is 84.44%. This indicates that safety data is being collected, analyzed, and acted upon in most programs, and on average, only small adjustments to SA programs will be required for CTP. AABI requires that programs have a "verifiable formal aviation safety program" that "incorporates SMS key

components appropriate to national guidance" (AABI, 2014). This could be the strongest explanation as to why the CTP average was so high, as only one CTP survey response was non-AABI accredited.[17]

Overall Results

The results of the averaged data indicate that the initial hypothesis was confirmed. The average total preparedness ratings were 47.09% for part 61 schools, 54.29% for part 141 schools, and 72.00% for collegiate programs. Figure 6 shows the combined information for all three major school types, comparing each component and the total compliance. One can easily see the trend line: on average, as regulatory oversight increases,[18] so does the school's compliance with the theoretical SMS program. This indicates that if the FAA were to implement an SMS program with components similar to those discussed in this paper, CTP programs would be minimally affected compared to part 61 programs.

Perception vs. Reality

In addition to the survey questions aimed at determining whether or not the school had a specific component, four generalized evaluative questions were also posed to the respondents. These questions were designed to make participants unknowingly rate themselves on compliance with each pillar of SMS through indirect statements related to the purpose of each SMS component.

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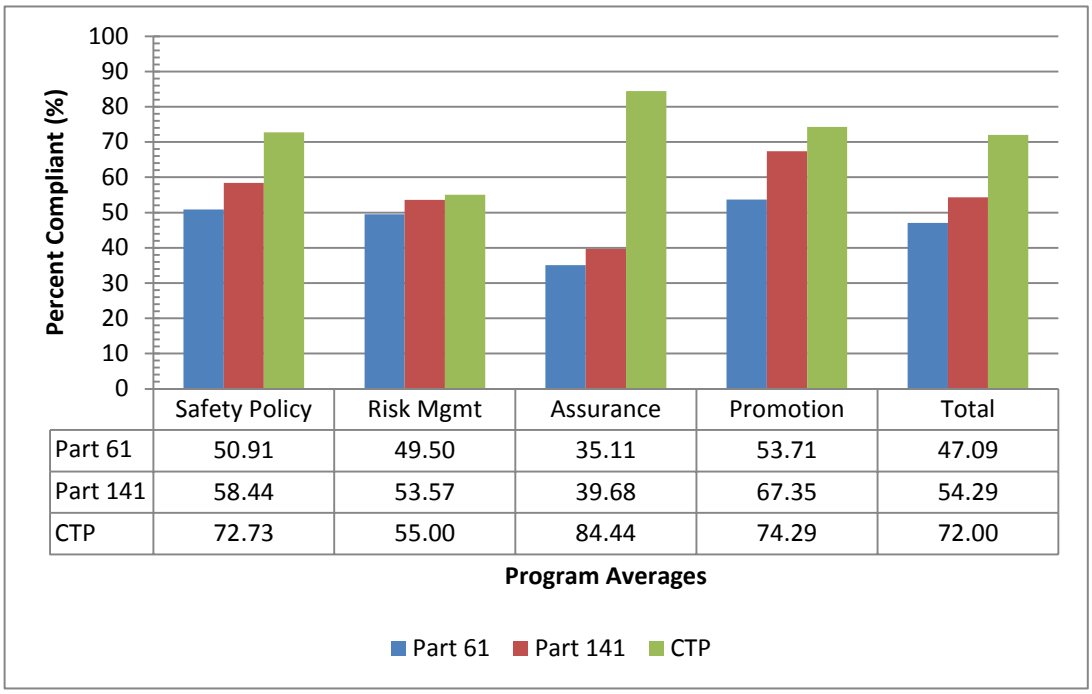
[17] Even the non-AABI accredited school showed significantly higher rates of compliance. Further research would be required to compare AABI vs non-AABI compliance.

[18] Part 61 is subject to minimal oversight, part 141 subject to some oversight, but CTP is subject to substantial oversight from FAA and accreditation sources.



	Safety Policy	Risk Mgmt	Assurance	Promotion	Total
Part 61	50.91	49.50	35.11	53.71	47.09
Part 141	58.44	53.57	39.68	67.35	54.29
CTP	72.73	55.00	84.44	74.29	72.00

Figure 6. Total compliance of all programs and all pillars.

The results were surprising: Appendix B displays on the right side the percentage of perceived compliance of each pillar with an average of each program at the bottom right. On average, schools accurately perceive their compliance with SMS. For example, part 61 has a total compliance percentage of 47.09%, and a perceived compliance percentage of 53.3%. Similar results are found in part 141 with a perceived compliance of 64% versus an actual compliance of 54%. CTP also continued the trend with a perceived compliance of 66% compared to an actual compliance of 72%.

While no empirical conclusions can be drawn from this data, it is interesting that schools are generally aware of how compliant they are with SMS; more

intriguing is the fact that the average respondent said it was "neutral" in its understanding of SMS.[19]

SMS Opinion Data

Attached to the end of the survey was an additional set of scalar questions asking participants to rate their opinion as, "strongly disagree," "disagree," "neutral," "agree," or "strongly agree." The questions were designed to gather information regarding the respondent's general understanding of SMS, whether the school thought it would be beneficial to introduce SMS, and whether respondent believed the financial cost of SMS was a factor in not implementing it. Refer to Appendix C for the data.

The first statement was, "I fully comprehend what the FAA's Safety Management System (SMS) does and its purpose." The average response was "agree." This may be a factor in how schools were able to determine their relative compliance, as the FAA has attempted several campaigns promoting SMS. The median response was also "agree."

The second statement was, "I believe that if the FAA mandated ALL flight schools to have an SMS program that safety would be significantly improved in general aviation." The purpose of this question was to see if schools actually believe SMS could work for GA. The average response was disagree, and the median response was neutral. That means several "strongly disagree" responses were received compared to few "strongly agree," but that several more "neutral" and "agree" responses were received compared to "disagree" responses. Overall, the

[19] See SMS Opinion Data.

responses indicate that schools believe implementing a SMS program will have no impact or that the impact will not be substantial.

The third statement was, "I believe the financial costs of a mandated safety program for my flight training program would be negligible." The average response was "neutral" and the median response was "disagree." This indicates several "disagree" responses, but more "strongly agree" responses than "strongly disagree." Based on this data, one could assume that schools generally find the financial costs negligible.

The following statements all rated" neutral" on both average and medians. This indicates either a lack of understanding or a feeling of indifference.

1. I believe that Fixed Based Operators (FBOs) and airport managers should be required to implement a safety program for its home based pilots and line employees.
2. I believe that mandating a SMS program in all flight schools would produce safer pilots.
3. I believe that ***NOT*** mandating a safety program would be more beneficial for flight schools.

In sum, the data indicate that schools have a basic understanding of SMS, they believe it will not significantly help to improve safety, they believe the financial costs are negligible, and they have no opinion either way on implementing it for FBOs. Additionally, schools appear indifferent on whether SMS would benefit their pilots.

The results of the opinion data coincide with the results of the component data. Schools are not going out of their way to implement SMS. However, most schools seem to have implemented the easier parts (Safety Policy and SP), while significantly lacking in the more technical and time-intensive areas of SA and SRM.

Final Conclusions

This research project produced some interesting and relevant results for the aviation industry. Utilizing airline safety strategies is clearly the next step towards resolving general aviation accidents and incidents (Garibay and Young, 2013). This could be accomplished through a variety of different systems and programs. Some previously suggested offering a live dispatching service to act as a virtual co-pilot (2013). Others have included the FAA mandated equipment requirements that will enhance situational awareness (FAA, 2015).

Ultimately, the only safety program with the track record to prove its worth in aviation is Safety Management Systems (Glendon and Clark, 2007). Its implementation in the GA environment is slowly taking place with larger programs adopting the key elements of Safety Assurance and Safety Promotion. The results indicate that Safety Assurance is the largest discrepancy between large schools and small schools. This is key, as Safety Assurance is arguably the most important pillar; the most fundamental question of SMS is how does a company manage change? (Stolzer and Halford, 2010). Safety Assurance is the ability to identify trends and manage change; thus, without the assurance process, SMS is not effective. To implement SMS for GA operations, one would need to develop a system of checks and balances that brings data into a central location for analysis on a local level

(Garibay and Young, 2013). This could be applied to local FBOs; an example would be to have an on-field safety representative to collect data and mandate that GA aircraft report all incidents to this person using some type of anonymous reporting form.

The Government Accountability Officer stressed that participation was the primary reason the FAA's current programs are failing. Therefore, requiring participation is the next logical step, and the data contained in this research indicates that part 61 and part 141 schools would have to implement roughly equal changes to their programs (GAO, 2011). Safety Assurance would be the biggest pillar to implement, and due to its tasking nature, most schools do not implement it outside the collegiate environment. To resolve this, it would be imperative for the FAA to develop a simplified reporting program for schools to adopt that would allow for meaningful safety impact without being overly burdensome on the schools limited personnel. Finding ways to adapt airline SMS to GA SMS would require critical thinking and cooperation between the FAA and the community, and AABI accredited schools would be a good starting point. The results of this survey indicate that collegiate training schools have almost full compliance with SA. Therefore, identifying the programs in use at these schools and fostering communication between smaller flight schools and collegiate programs could help bridge the gap between airline level SMS and a local level SMS.

Additionally, the implementation of Safety Risk Management would be potentially the most difficult. Although Safety Assurance would require a program

for reporting and analysis, with proper training it could be done.[20] SRM is lacking in all schools, including collegiate programs. This means that the FAA would not be able simply to help schools adopt a program, but would need to teach an understanding of risk management and mitigation. James Reason's book implores that risk management can be vastly different depending on the company and type of operation, meaning each risk management program must be individually tailored. (Reason, 1997). Because SRM is lacking by approximately 50% compliance across the board, significant strides would be required to induce a proper understanding of risk and hazard management, formalize the process, and then implement a program.

Additional research could be conducted to more fully analyze how implementing a SMS system in GA could occur. Potential areas include whether or not SMS would actually improve GA accident rates as aggressively as it did commercial flight rates. A cost analysis study could also be performed to identify one-time and long-term costs associated with SMS, and those results could then be used to determine the potential financial implications of SMS for GA schools. With SMS showing such promising results for airlines, it is imperative to investigate the potential it has for solving the stagnated GA accident rate, especially with the significantly lacking critical SMS components of SA and SRM.

[20] Evident through the existence of SA programs in collegiate training.

Appendix A. Survey questions.

Which of the following best describes your flight school?

Part 141, Part 61, Collegiate Training Program

If 141 or 61, which of the following applies?

1 to 49 students or 50+ students?

1 or 2 aircraft in service or 3+ aircraft in service?

If Collegiate Program, are you AABI accredited?

Does your training program have an anonymous reporting process for students and employees to report safety incidents?

If yes, does voluntary disclosure protect the reporter from most ramifications?

Does your program establish safety goals and objectives?

If yes, are those goals assessed and updated regularly?

Are your safety goals clearly stated and visibly posted to those operating in the building?

Do employees from different sectors meet to discuss operational concerns related to safety on a regular basis? This might include maintenance personnel, office staff, flight instructors, chief instructors, records personnel, etc.

Do you have a dedicated employee who is solely responsible for managing your safety program? Examples include a Safety Manager, Safety Supervisor, or Safety Monitor.

If yes, does this employee have other duties besides safety oriented tasks?

Do you have a dedicated student or group of students to act as student safety ambassadors to the program?

Are students given the opportunity to suggest changes to operations or safety programs anonymously?

Does your school publish a document outlining your safety program that is readily available to students and staff?

If yes, please check each item below that the document contains.

A) Fleet Information
B) Operating Limitations (Weather Minimums, Etc)
C) Incident Reporting Process
D) Safety Program Manager contact information
E) Emergency Action Plan
F) Procedures for off-site emergencies or incidents
G) Line procedures (ID Badging, Fueling procedures, etc)
H) Maintenance discrepancy process
I) An outline of your safety goals, commitments, and program

Does your program require maintenance problems to be reported to a central person/office?

If yes, is a written document submitted that outlines the problems, corrective action taken, and status of the aircraft?

Does EACH student receive a copy of aircraft checklists and program operating procedures?

Does your program collect and store data on safety incidents?

If yes, does it self-audit this data to identify trends?

Does your program receive third-party audits of its safety program?

Does your program conduct regular safety meetings with employees to discuss factors contributing to safety and factors degrading it?

If yes, are employees free to discuss any aspect of the program without repercussion?

Does your program have a risk management plan that clearly identifies each risk your program faces and ways to mitigate each risk?

Does your program have a risk identification process that actively seeks out current and evolving risks?

Is there an individual responsible for risk assessment and mitigation?

If yes, is this person also the safety program manager?

Are new employees provided training on your safety program and/or procedures?

Are new students trained on your safety program and/or procedures?

Are all reported safety incidents distributed to employees and students for review? This could be emailed or posted publically in the building.

Have local emergency responders been briefed on your operations and hazards associated with aviation?

After a safety incident is reported, does someone assess your current safety program/procedures to determine if changes should be made?

Does your program have a proactive plan to assess hazards?

If your program rents aircraft, are renters required to undergo the same safety training as students?

If your program rents aircraft, are renters subject to the same rules and operating limitations as students?

Please read the following and then rate how accurately the statement describes your program:

This is a 1 to 10 scale. 10 means your strongly agree with the statement. 1 indicates you strongly disagree with the statement.

1. My program actively promotes safety though all levels of the workforce. It includes training, communication, scenarios, and activities to strengthen our safety culture. Teamwork in safety is promoted and regular, open discussions amongst employees take place. Safety manager(s) are proactive in identifying hazards.

2. My program evaluates the continued effectiveness of its risk control strategies and identifies new hazards. We ensure compliance with all regulations and go above and beyond what is required in a safety program. We collect data and analyze that data for trends and regularly asses our safety program's effectiveness.

3. My program actively identifies risks and has a plan in place to control risk. Our risk management plan is published for all to see, and we support involvement of students and employees in containing and identifying risk. This is a formal process that documents what the risk is, hazards associated with it, and methods to control the risk.

4. My program's managers actively promote safety throughout the organization, not only through words, but also through actions. The program has clearly defined methods and processes to preserve safety, and there are established goals and objectives to meet. There is transparency in the safety program, and all incidents are fully documented with a resolution process. Results of this resolution process are distributed publically. Managers promote cross-organizational communication and cooperation.

<u>Finally, please answer the following statements regarding your view on the FAA's Safety Management System as it applies to your flight school.</u>

I fully comprehend what the FAA's Safety Management System (SMS) does and its purpose.

- Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree.

I believe that if the FAA mandated ALL flight schools to have an SMS program that safety would be significantly improved in general aviation.

- Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree.

I believe the financial costs of a mandated safety program for my flight training program would be negligible.

- Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree.

I believe that Fixed Based Operator's (FBO's) and airport managers should be required to implement a safety program for its home based pilots and line employees.

- Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree.

I believe that mandating an SMS program in flight schools would produce safer pilots.

- Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree.

I believe that **NOT** mandating a safety program would be more beneficial for flight schools.

- Strongly Disagree, Disagree, Neutral, Agree, or Strongly Agree.

Appendix B. Survey response data sheet.

Responses					Q14: 1 to 3=1; 4 to7 = 2; 8+ = 3																													
1=61, Small		2 = 61 Large		3=141 Small	4= 141 Large						5= CFT																							
				Q#	5	6	7	8	9	#	11	12	13	14	15	16	17	18	19	20	#	22	23	24	25	26	27	28	29	30	31	32	33	34
	CAT	Reg Type	Student	Planes	1	1	2	1	1	2	1	1	2	3	2	1	2	1	2	1	1	2	1	1	1	1	1	1	1	1	10	10	10	10
#1	1	61	1 to 49	1 or 2	0	0	1	0	0	1	0	0	1	2	1	0	1	0	1	0	0	1	1	1	0	0	1	1	1	1	5	4	3	4
#4	1	61	1 to 49	3	0	0	2	1	1	1	0	0	0	0	2	1	0	0	2	0	0	0	0	1	1	1	1	0	1	1	10	10	4	10
#7	1	61	1 to 49	1 or 2	0	1	1	0	0	1	0	0	0	0	1	1	0	0	0	1	1	1	0	1	0	1	1	0	1	1	1	1	1	1
#9	1	61	1 to 49	3	0	0	0	0	1	0	0	1	0	0	2	1	1	0	2	0	1	2	1	0	1	1	0	0	0	1	6	6	1	8
#11	1	91	1 to 49	3	0	0	2	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	1	1	0	1	0	1	1	1	9	9	9	9
#12	1	61	1 to 49	1 or 2	0	0	2	1	1	1	0	0	0	0	1	0	0	0	0	0	1	1	1	1	1	1	0	1	1	0	1	1	5	1
#13	1	61	1 to 49	1 or 2	1	1	1	0	0	1	0	1	0	0	1	1	1	1	1	0	1	0	0	0	0	0	1	1	1	1	9	9	10	9
#14	1	61	1 to 49	1 or 2	0	0	1	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	1	1	0	0	1	0	1	1	5	4	4	4
#15	1	61	1 to 49	3	0	0	1	0	0	1	0	1	1	3	2	1	0	0	0	0	0	1	1	1	0	0	0	0	1	1	4	4	4	5
#17	1	61	1 to 49	1 or 2	0	0	2	1	1	1	0	1	0	0	1	1	2	0	1	1	1	1	1	1	1	1	1	1	1	0	8	8	8	8
#19	1	61	1 to 49	3	0	0	2	0	0	1	0	0	1	2	2	1	0	0	2	1	0	1	1	1	0	0	0	1	1	0	9	5	5	5
#20	1	61	1 to 49	3	0	0	1	0	1	1	0	0	0	0	2	0	1	0	2	0	0	2	1	1	0	1	1	1	1	1	4	4	4	4
#21	1	61	1 to 49	3	0	0	1	0	0	0	0	1	0	0	2	1	0	0	0	0	0	0	0	1	0	0	0	0	1	1	6	6	7	9
#23	1	61	1 to 49	1 or 2	0	0	0	0	0	2	0	0	0	0	2	1	0	0	2	0	0	1	0	0	0	0	0	0	0	1	3	5	1	1
#25	1	61	1 to 49	1 or 2	0	0	2	0	0	1	0	0	1	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	6	1	2
#26	1	61	1 to 49	1 or 2	1	1	2	1	1	0	1	1	0	0	2	1	1	0	2	1	1	2	1	1	1	1	1	1	1	1	8	8	8	8
#27	1	61	1 to 49	3	0	0	1	0	1	0	0	1	1	2	1	1	0	0	2	0	0	0	1	1	0	1	0	0	1	1	8	6	6	6
#29	1	61	1 to 49	1 or 2	0	1	0	0	1	1	0	1	1	2	2	1	0	0	2	0	0	1	1	1	0	0	0	1	1	1	9	6	3	5
#30	1	61	1 to 49	3	0	0	2	1	1	1	0	0	0	0	2	1	2	1	2	0	1	2	1	1	1	1	1	1	1	1	8	9	2	9
#31	1	61	1 to 49	3	0	1	1	0	0	1	0	1	1	2	1	1	0	0	1	0	0	0	1	1	0	1	1	0	1	0	4	6	5	5
#32	1	61	1 to 49	1 or 2	0	1	0	0	0	0	0	0	1	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	5	2	2	2
#33	1	61	1 to 49	1 or 2	0	0	2	0	1	0	0	1	1	0	0	1	1	0	2	1	1	2	1	1	1	1	0	1	0	0	5	5	5	5
#3	2	61	50	3	0	0	1	0	1	0	0	1	1	2	2	0	1	0	0	0	0	0	1	1	0	1	0	0	0	1	4	4	3	2
#6	2	61	50	3	1	1	2	0	0	1	0	1	1	1	1	1	1	0	2	0	1	2	1	1	0	1	0	1	1	1	9	8	8	8
#28	2	61	50	3	0	1	0	0	1	0	0	0	1	1	1	1	0	0	2	0	0	0	1	1	0	1	0	0	1	1	4	6	3	4
#8	3	141	1 to 49	3	0	1	2	1	1	1	0	1	1	3	2	1	2	1	1	1	1	1	1	1	0	1	0	1	1	1	8	8	8	8
#16	3	141	1 to 49	3	0	1	2	1	1	1	0	1	0	0	2	1	0	1	2	1	1	1	1	1	1	1	0	1	1	1	10	10	7	9
#18	3	141	1 to 49	3	0	0	1	0	0	1	0	0	0	0	2	1	0	0	2	0	0	0	1	1	0	1	1	1	0	1	7	4	4	4
#22	3	141	1 to 49	3	0	0	0	1	1	1	0	1	0	0	2	0	0	0	2	0	0	1	1	1	0	1	0	1	0	0	9	9	1	10
#34	3	141	1 to 49	1 or 2	0	0	2	0	1	1	0	1	1	2	1	1	0	0	0	0	0	2	0	1	1	0	1	1	0	0	5	5	5	5
#10	4	141	50	3	0	0	1	1	1	1	0	1	1	3	1	1	0	0	2	0	0	0	1	1	0	1	1	0	1	1	7	4	5	5
#24	4	141	50	3	0	0	2	1	1	1	0	0	1	3	2	1	1	0	2	0	0	1	1	1	1	1	0	0	1	1	8	5	5	5
#5	5	CTP	AABI	-	1	1	1	1	1	1	0	1	1	2	2	1	1	1	1	0	0	1	1	1	1	1	0	0	1	1	7	4	5	8
#35	5	CTP	AABI	-	1	1	2	1	1	1	0	1	1	3	2	1	2	1	1	1	0	1	1	1	1	1	0	1	1	0	7	5	8	7
#36	5	CTP	-	-	1	1	1	0	1	1	1	1	1	3	1	1	1	0	1	0	0	1	1	1	1	1	0	0	1	1	6	3	4	6
#2	5	CTP	AABI	-	1	1	2	1	1	1	0	1	1	3	2	1	2	1	2	1	0	1	1	1	1	1	1	1	1	1	8	8	9	9
#37	5	CTP	AABI	-	1	1	1	0	1	2	0	1	1	2	2	1	2	1	1	0	1	1	1	1	0	1	1	1	0	1	7	8	5	7

	Program Elements										Perception				
	1- Policy		2 - Risk Mgmt		3 - Assurance		4 - Promotion		Total		Total	1	2	3	4
	Points	%	Points	%	Points	%	Points	%	Points	%	%	%	%	%	%
	11	100	8	100	9	100	7	100	35	100.00	100	100	100	100	100
#1	6	54.5	4	50	2	22.22	3	42.86	15	42.86	40	40	30	40	50
#4	5	45.5	3	37.5	2	22.22	5	71.43	15	42.86	85	100	40	100	100
#7	4	36.4	5	62.5	3	33.33	1	14.29	13	37.14	10	10	10	10	10
#9	2	18.2	5	62.5	3	33.33	5	71.43	15	42.86	52.5	80	10	60	60
#11	7	63.6	2	25	2	22.22	2	28.57	13	37.14	90	90	90	90	90
#12	4	36.4	4	50	2	22.22	4	57.14	14	40.00	20	10	50	10	10
#13	4	36.4	4	50	6	66.67	1	14.29	15	42.86	92.5	90	100	90	90
#14	5	45.5	2	25	1	11.11	2	28.57	10	28.57	42.5	40	40	40	50
#15	8	72.7	3	37.5	2	22.22	2	28.57	15	42.86	42.5	50	40	40	40
#17	5	45.5	6	75	5	55.56	5	71.43	21	60.00	80	80	80	80	80
#19	7	63.6	5	62.5	1	11.11	4	57.14	17	48.57	60	50	50	50	90
#20	3	27.3	6	75	3	33.33	5	71.43	17	48.57	40	40	40	40	40
#21	4	36.4	2	25	1	11.11	1	14.29	8	22.86	70	90	70	60	60
#23	2	18.2	3	37.5	2	22.22	2	28.57	9	25.71	25	10	10	50	30
#25	6	54.5	1	12.5	1	11.11	1	14.29	9	25.71	25	20	10	60	10
#26	6	54.5	8	100	5	55.56	7	100.00	26	74.29	80	80	80	80	80
#27	7	63.6	1	12.5	2	22.22	5	71.43	15	42.86	65	60	60	60	80
#29	6	54.5	4	50	3	33.33	5	71.43	18	51.43	57.5	50	30	60	90
#30	6	54.5	7	87.5	5	55.56	6	85.71	24	68.57	70	90	20	90	80
#31	6	54.5	2	25	4	44.44	3	42.86	15	42.86	50	50	50	60	40
#32	5	45.5	1	12.5	1	11.11	0	0.00	7	20.00	27.5	20	20	20	50
#33	4	36.4	5	62.5	3	33.33	6	85.71	18	51.43	50	50	50	50	50
#3	5	45.5	2	25	3	33.33	3	42.86	13	37.14	32.5	20	30	40	40
#6	7	63.6	5	62.5	6	66.67	4	57.14	22	62.86	82.5	80	80	80	90
#28	5	45.5	1	12.5	2	22.22	5	71.43	13	37.14	42.5	40	30	60	40
#8	10	90.9	6	75	7	77.78	4	57.14	27	77.14	80	80	80	80	80
#16	6	54.5	6	75	5	55.56	6	85.71	23	65.71	90	90	70	100	100
#18	3	27.3	4	50	2	22.22	4	57.14	13	37.14	47.5	40	40	40	70
#22	1	9.09	4	50	3	33.33	5	71.43	13	37.14	72.5	100	10	90	90
#34	6	54.5	5	62.5	2	22.22	3	42.86	16	45.71	50	50	50	50	50
#10	9	81.8	2	25	3	33.33	5	71.43	19	54.29	52.5	50	50	40	70
#24	10	90.9	3	37.5	3	33.33	6	85.71	22	62.86	57.5	50	50	50	80
#5	8	72.7	3	37.5	7	77.78	5	71.43	23	65.71	60	80	50	40	70
#35	9	81.8	5	62.5	8	88.89	5	71.43	27	77.14	67.5	70	80	50	70
#36	8	72.7	2	25	6	66.67	6	85.71	22	62.86	47.5	60	40	30	60
#2	9	81.8	6	75	8	88.89	6	85.71	29	82.86	85	90	90	80	80
#37	6	54.5	6	75	9	100	4	57.14	25	71.43	67.5	70	50	80	70
	61 Avg	50.91		49.50		35.11		53.71		47.09	53.3	53.6	44.8	56.8	58
	141 Avg	58.44		53.57		39.68		67.35		54.29	64.286	65.714	50	64.29	77.14286
	CTP Avg	72.73		55.00		84.44		74.29		72.00	65.5	74	62	56	70
		Safety Policy	Risk Mgmt		Assurance		Promotion		Total						

Appendix C. Opinion data responses.

								1 - SD
	CAT	35	36	37	38	39	40	2= D
Response #		5	5	5	5	5	5	3 - N
1	1	4	4	4	2	3	4	4 - A
2	4	3	2	4	3	2	2	5 - SA
3	2	4	2	3	4	1	4	
4	1	2	2	2	2	2	4	
5	6	4	3	5	4	4	3	
6	2	4	2	2	2	2	5	
7	1	5	1	1	1	1	5	
8	3	3	4	2		3	3	
9	1	5	2	2	2	3	2	
10	4	-	-	-	-	-	-	
11	1	5	3	4	4	4	3	
12	1	-	-	-	-	-	-	
13	1	3	3	2	5	3	2	
14	1	3	3	3	3	3	3	
15	1	5	2	2	4	4	4	
16	3	4	3	4	3	3	3	
17	1	5	2	2	2	2	4	
18	3	2	2	1	1	2	3	
19	1	3	3	3	3	3	3	
20	1	3	2	3	1	3	4	
21	1	4	3	2	3	3	3	
22	3	1	1	1	1	1	5	
23	1	3	2	3	5	3	3	
24	4	4	4	4	4	4	2	
25	1	4	2	1	4	2	3	
26	1	4	1	1	2	2	5	
27	1	3	2	2	3	3	3	
28	2	1	1	2	5	3	3	
29	1	3	3	3	3	3	3	
30	1	5	3	4	2	4	3	
31	1	4	2	3	1	2	4	
32	1	2	1	1	1	1	5	
33	1	4	2	1	4	2	3	
34	3	-	-	-	-	-	-	
35	5	4	4	4	3	4	2	
36	5	4	4	4	4	3	2	
AVG		4	2	3	3	3	3	
MEDIAN		4	3	2	3	3	3	

Refer to Appendix A, page 38.12 for question text. Responses are listed above, averages and medians below. The first row is the response number, the second is the respondent's category of school, and the subsequent rows are the answers to the survey questions numbered 35 through 40. A score of 1 means strongly disagree, and a score of 5 means strongly agree.

Appendix D. Statement of consent.

Thank you for your time and willingness to participate in this research project.

This study is designed to identify components of your flight school's safety program. The data will then be compared to current Federal Aviation Administration (FAA) Safety Management Systems (SMS) to determine how compliant your program is with these standards.

Your data will remain anonymous and all responses are kept secured. Participation is voluntarily, and there are no penalties for not responding to the survey.

If you choose to participate, you understand that you are giving the researcher consent to use the data in his research project to further understand general aviation safety programs as compared to FAA standards for airlines.

Results of the study can be provided to you if you choose. This option will be presented at the end of the survey.

This survey should take approximately 8 minutes to complete.

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September 23, 2015

Investigator(s): Zachary K Hutcherson, Paul Craig
Department: Aerospace
Investigator(s) Email: zkh2c@mtmail.mtsu.edu, paul.craig@mtsu.edu

Protocol Title: "The Projected Ability of General Aviation to Adapt to a Comprehensive Mandated Safety Program "

Protocol Number: 16-2055

Dear Investigator(s),

The MTSU Institutional Review Board, or a representative of the IRB, has reviewed the research proposal identified above. The MTSU IRB or its representative has determined that the study poses minimal risk to participants and qualifies for an expedited review under 45 CFR 46.110 and 21 CFR 56.110, and you have satisfactorily addressed all of the points brought up during the review.

Approval is granted for one (1) year from the date of this letter for 1,500 participants.

Please note that any unanticipated harms to participants or adverse events must be reported to the Office of Compliance at (615) 494-8918. Any change to the protocol must be submitted to the IRB before implementing this change.

You will need to submit an end-of-project form to the Office of Compliance upon completion of your research located on the IRB website. Complete research means that you have finished collecting and analyzing data. **Should you not finish your research within the one (1) year period, you must submit a Progress Report and request a continuation prior to the expiration date.** Please allow time for review and requested revisions. Failure to submit a Progress Report and request for continuation will automatically result in cancellation of your research study. Therefore, you will not be able to use any data and/or collect any data. Your study expires **9/23/2016**.

According to MTSU Policy, a researcher is defined as anyone who works with data or has contact with participants. Anyone meeting this definition needs to be listed on the protocol and needs to complete the required training. **If you add researchers to an approved project, please forward an updated list of researchers to the Office of Compliance before they begin to work on the project.**

All research materials must be retained by the PI or faculty advisor (if the PI is a student) for at least three (3) years after study completion and then destroyed in a manner that maintains confidentiality and anonymity.

Sincerely,

Timothy R. Graeff
Institutional Review Board Member
Middle Tennessee State University